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Subcommittee on Strategic Forces

The Future of Missile Defense Testing

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Chairwoman Tauscher, Ranking Member Turner, distinguished Members of the Committee, I very much appreciate the opportunity to appear before you today to support your examination of the Department of Defense programs in missile defense and the future of missile defense testing.

I am a Senior Advisor to the non-profit Center for Defense Information, a division of the World Security Institute, a Washington, D.C.-based national security study center. To help insure our independence, the World Security Institute and the Center for Defense information do not accept any funding from the Federal government, nor from any defense contractors.

In 2005 and 2006, I served on the nine-member Defense Base Realignment and Closure Commission, appointed by President George W. Bush and nominated by House Democratic Leader, Nancy Pelosi.

Beginning in late 2004, I served on Governor Arnold Schwarzenegger's Base Support and

Retention Council, from which I resigned to serve on the President's Commission.

From 1994 to 2001 I served in the Pentagon as Assistant Secretary of Defense and Director, Operational Test and Evaluation. In this capacity, I was principal advisor to the Secretary of Defense and the Undersecretary of Defense for Acquisition, Technology and Logistics on test and evaluation in the DOD. I had OSD OT&E responsibility for over 200 major defense acquisition systems including the present-day missile defense programs.

From 1959 to 1979, and again from 1981 to 1993, I worked at the Lawrence Livermore National Laboratory. Over those 33 years I worked on a variety of high technology programs, and retired from the Laboratory in 1993 as Laboratory Associate Director and deputy to the Director.

In my current capacity at the Center for Defense Information I am called upon to provide independent analysis on various defense matters. I have over 40 years of experience involving U.S. and worldwide military research, development and testing, on operational military matters, and on national security policy and defense spending.

Introduction

There is a troublesome lack of clarity in public discourse regarding both the rationale for and the technical progress toward an effective U.S. missile defense network. Quite simply, the public statements made by Pentagon officials and contractors have often been at variance with the facts at hand. It is difficult to separate programmatic spin from genuine progress. In particular, the missile defense program has made claims that have not been demonstrated through realistic testing.

In this prepared testimony I outline the steps that the Missile Defense Agency must take. These include:

1. Test to establish operational criteria, such as the levels of effectiveness the system can and cannot achieve. For example, is it acceptable if the system is only 10 percent effective and 90 percent of enemy missiles get through?
2. Test to demonstrate that the system can withstand attacks involving multiple missiles – not just one or two.
3. Test to demonstrate that the system is operationally effective in the presence of realistic decoys and countermeasures.
4. Test to eliminate the gaps left from past flight intercept tests, including years of kicking the can down the road on basic operational questions such as can the system work at night, in bad weather, or under likely battlefield conditions?

The most complex defense acquisition programs can face scientific and technical obstacles which if not conquered are so fundamental that the programs will fail. For missile defense, the most challenging technical obstacles are dealing with enemy attacks or more than one or two missiles and with decoys and countermeasures that can defeat missile defense. So far the testing programs have been kicking that can down the road.

I'd like to make an analogy. Suppose the Pentagon had a program in which I was going to prove that I could flap my arms and fly. Millions of dollars could be spent building a special runway for my project. I might also need some special ramps and launchers, some feathers for my arms, and a hangar for my supplies and to get out of the rain. Then I would need a special air traffic control system. Flying humans are not yet a risk to commercial aviation but they certainly could be if humans could fly.

I might also need a mid-air refueling system. Flapping one's arms and flying takes a lot of energy, so I might need a way to be fed in flight.

For years the Pentagon and I could provide progress reports to Congress without ever testing the fundamental physics behind my project to fly. We would report on the progress with the construction of the runway, the hangar, and the launchers and ramps. Because a human body has a smaller radar cross section than a 747 we might have setbacks with the new air traffic control system and ask Congress for more time and money. The mid-air refueling system might be especially challenging, but wanting to support this intriguing new project, Congress might let me string them along for years without engaging the fundamental question that human flight entails, namely, can I really flap my arms and fly? If I can't solve that problem, my human flight project is doomed, even though I might have made marvelous progress on the other steps leading up to my ultimate challenge: real physical, human-powered flight.

Missile defense faces an analogous problem. From dedicated testing we need to find out if under realistic operational conditions the program can “fly.”

In my imaginary program for human flight, I may have convincing computer models that show that I can fly. Leonardo DaVinci thought it was possible. But without tests that discover and demonstrate the basic principles, all my computer models will just be unproven theories.

“The Enemy Has a Vote”

Our military often observes, “The enemy has a vote.” In missile defense this means that if the enemy is bound and determined to attack us, they will do whatever they can to overwhelm and confound U.S. missile defenses. This means that the enemy may launch many missiles, not just one or two, may make their warheads stealthy and hard to detect and track, and may use decoys and other types of countermeasures to fool or confuse the defenses. The enemy may attack at night or in bad weather, may use electronic jamming, and may use stealth.

Recently the White House said this about National Missile Defense: “The Obama-Biden Administration will support missile defense, but ensure that it is developed in a way that

is pragmatic and cost-effective; and, most importantly, does not divert resources from other national security priorities until we are positive the technology will protect the American public.”

How will the administration and Congress be positive that missile defense will protect the American public?

To do this is going to require testing far beyond what we have seen to date.

The easiest ways for an enemy to overwhelm missile defenses are to:

1. Build more offensive missiles,
2. Use decoys and countermeasures to fool the defenses, and
3. Attack in ways that ballistic missile defenses are not designed to handle, such as with cruise missiles, or through terrorism or insurgency.

The Missile Defense Agency does not have a charter to counter terrorism, but the MDA is responsible to address the ways that an adversary might try to overcome or fool our missile defenses. The testing program must put those issues front and center, but that has not been happening.

Just as it would make no sense to avoid testing my ability to flap my arms and fly in my hypothetical project human flight project, it also makes no sense to avoid testing the ability of our missile defenses to handle the real world conditions of battle, an attack of more than one or two missiles, and the confusion from decoys and countermeasures.

A Perspective on the Threat

The Pentagon is developing a variety of missile defense systems, - land, sea, air, and possibly space-based – but the Ground-based Midcourse Defense system (GMD) – formerly called National Missile Defense (NMD) – attracts the most attention from lawmakers and the media. It is the largest and most complex of the systems, and the most costly. It is also the centerpiece in the current Defense Department plan for

defending the United States from long-range intercontinental ballistic missiles (ICBMs) fired by a hostile enemy. Closely related to the GMD system is the controversial U.S. missile defense system proposed for Europe which would establish an interceptor missile field in Poland and an X-band radar in the Czech Republic.

In my prepared testimony today I concentrate on those two systems, and make three overarching points:

(1) In my view, Iran is not so suicidal as to attack Europe or the United States with missiles. To me it is not credible that Iran would be so reckless as to attack Europe, or the United States, with a single missile – and also with no decoys or countermeasures - and then sit back and wait for the consequences. As we know, ballistic missiles have return addresses.

The launch of a small satellite by Iran earlier this month does not change this situation.

Similarly, North Korea is not so suicidal as to attack Japan or the United States with missiles, and North Korea is negotiating an end to its nuclear programs. Both Iran and North Korea have done some reckless things, but they know that an attack on Europe, Japan, or the U.S. would justify massive retaliation.

(2) Those who believe that Iran is bound and determined to attack Europe or America no matter what, also have to assume that Iran would do whatever it takes to overwhelm our defenses, including using decoys to fool the defenses, launching stealthy warheads, and launching many missiles, not just one or two. The Missile Defense Agency admits it can't handle that situation today, and accordingly their testing program must begin to address these challenges soon.

(3) The Pentagon claims to be able to handle at best one or possibly two missiles from Iran. If Iran believed that U.S. missile defenses were effective, and if Iran were reckless enough to attack Europe or the United States, Iran would simply build more missiles to overwhelm our defenses. This would hurt U.S. security. Thus if Iran did attack Europe

with more than one or two missiles, the missile defense system as proposed couldn't defend Europe anyway. Developing an effective system will require much new testing.

In its January 30, 2009 report to Congress, "Assessment Testing and Targets Program," the Missile Defense Agency (MDA) writes, "MDA conducts flight tests to verify, not to discover." [1] I fundamentally disagree with this, not because testing isn't needed to verify models and simulations – it is – but because without testing to discover, MDA will not be able demonstrate to itself and to the Congress that its programs can be operationally effective.

Besides, the MDA statement is not true; MDA discovers something in every flight test.

But more to the point, in the future, testing to discover will need to be paramount if the MDA is to address the many technical obstacles that they face. Avoiding discovery leads nowhere.

Last week Lt. Gen. O'Reilly invited me to meet with him, and also to spend the next day with his staff in briefings. I very much appreciate Gen. O'Reilly's courtesy. He described to me the three-phase review of the entire Ballistic Missile Defense System (BMDS) that he has just begun, and his philosophy for realistic testing for discovery and to address critical factors such as I enumerated above. A decade ago, then Col. O'Reilly demonstrated the importance of testing to discover in the THAAD program, and I believe he is trying to apply now that same straightforward testing philosophy to all missile defense programs in the MDA portfolio. Given the size and complexity of the overall BMDS this change in culture will not come easily. Demanding and attentive oversight by this Subcommittee will be critical if MDA is ever to provide effective and suitable systems.

As I explain with illustrative examples in my prepared testimony below, missile defense faces many daunting technical issues. Unless those critical issues are confronted head on,

missile defense will have reached a dead end. Thus MDA has no real choice but to embrace the philosophy and approach, which Gen. O'Reilly has charted.

The Current Lack of Operational Criteria

In reviewing the status of U.S. missile defense testing programs, I want to stress that the current programs have no operational criteria for success. How good is the system supposed to be? Is 10% effectiveness good enough? What about 1%? Can the system handle realistic threats as documented in Intelligence Community threat assessments? How many interceptors should be required to defeat one target?

Without answers to such questions, it is very difficult to design an adequate testing program, and for the U.S. Congress to evaluate the results. And, as has often been noted by the GAO, it also makes it difficult for the GAO or for my former office in the Pentagon to evaluate these programs for the Congress.

This also explains why the warfighter, e.g. STRATCOM, has been reluctant to say that the United States has an operational capability or whether it would be effective.

Nearly a decade ago President Clinton established four criteria against which he would make a deployment decision. The Clinton criteria, announced by the White House in December 1999, a year before he would make a decision, were:

1. "Whether the threat is materializing;
2. The status of the technology based on an initial series of rigorous flight tests, and the proposed system's operational effectiveness;
3. Whether the system is affordable; and
4. The implications that going forward with National Missile Defense (NMD) deployment would hold for the overall strategic environment and our arms control objectives."

At that time the goal was to be able to shoot down a single missile from an accidental or unauthorized launch from Russia or China, not to be able to defend against a deliberate missile attack. But at that time there had only been only three NMD flight intercept tests, and because the last two of those three tests failed, the missile defense system clearly was shown not to be effective.

As a result, President Clinton did not have to devote much time considering the cost or the international relations aspects of his decision to not deploy the system. The system simply had not been shown to be effective, and that was that.

During the Reagan years, Paul Nitze, the highly regarded scholar and statesman, presented three criteria that any - in those days it was the Strategic Defense Initiative (SDI) - missile defense system must meet before being considered for deployment. Nitze's criteria were formally adopted as National Security Directive No. 172 on May 30, 1985. The Nitze criteria were:

1. The system should be effective;
2. Be able to survive against direct attack; and
3. Be cost effective at the margin - that is, be less costly to increase your defense than it is for your opponent to increase their offense against it.

The Ground-based Missile Defense system being deployed in Alaska and California, and the proposed U.S. missile defense system for Europe, meet none of the above criteria, not the Clinton criteria and not the Nitze criteria. And new or different criteria for the system were not established by the administration of George W. Bush.

In making his decision in December, 2002, to deploy the GMD system in Alaska and at Vandenberg AFB in California by the end of 2004, President George W. Bush appears to have had no criteria other than a commitment to deploy hardware as quickly as possible.

As a result, U.S. missile defenses are being deployed without well-established operational criteria, and the Congress has no baseline from which to evaluate these missile defense programs.

For this reason, the criteria described above, both the Clinton criteria and the Nitze criteria, are still helpful today in helping us to gauge where we stand with missile defense, what we have gotten for the effort, and where we should be going.

The Lack of an Overall BMDS Architecture

The Missile Defense Agency (MDA) is pursuing a path of “spiral development,” sometimes called, “Capability-Based Acquisition,” concepts which have been taken to an unworkable extreme by the MDA. The extreme example is the overall Ballistic Missile Defense System about which the Missile Defense Agency has insisted, “There are currently no final or fixed architectures and no set of operational requirements for the proposed BMDS.”

Under this approach, spiral development or other “dynamic acquisition” concepts become like building a house while the floor plan is constantly changing. It makes for a very expensive house, and if your family ever gets to move in, they find they don’t like how their topsy-turvy house turned out.

With dynamic acquisition processes, especially capability-based acquisition, there may be no established baseline for even the first increments. In missile defense, and a few other complex DOD programs, the problems with dynamic acquisition stem from a lack of definite requirements.

The Defense Science Board has advised the DOD that “Each spiral should be an enforced baseline,” and adds, “There needs to be a careful assessment of technological readiness, with risk reduction activity outside and preceding major program activity where significant technical risks exist.” [2]

In missile defense, this advice is too often not heeded.

Without an enforced baseline of requirements or other established criteria, Congress cannot rely on the Pentagon's cost estimates, or know whether an effective system will result. Without established criteria Congress is buying another Winchester Mystery House, that famous 160-room Victorian mansion in San Jose, California, that was under continuous construction for 38 years without any master building plan. The maze-like house has staircases that lead to nowhere, second floor outside doors that open to nothing except a 10 foot drop, and oddly arranged rooms where you would least expect them.

Missile defense is the most difficult developmental program the Pentagon has ever attempted, beyond any Army tank, Navy ship, high performance jet fighter or helicopter. And those developmental programs often take 20 years or more. Missile defense has been under development in the United States for 60 years. A conservative estimate is that the U.S. has spent more than \$120 billion on missile defense. From looking at figures from the Congressional Budget Office, I would estimate that since President Reagan's famous 'Star Wars' speech in 1983, about \$150 billion has been spent. [3] And over the next five years, the Pentagon has requested another \$62.5 billion for missile defense, with no end in sight.

If the Congress supports this spending on missile defense, by the end of 2013 over \$110 billion will have been spent just since 2003, not counting the missile defense spending in the previous 20, 40, or 60 years.

To continue this level of spending without first knowing from realistic test results whether the overall BMDS can fly would be a costly mistake.

Testing to Withstand Enemy Salvo Launches or Multiple Missile Attacks

To be effective against even a relatively unsophisticated enemy, U.S. missile defenses must be able to withstand attacks involving more than one or two missiles. This is because it is relatively inexpensive for an adversary to build more offensive missiles once

it has developed and produced the first. Also, knowing that the first interceptor might miss, and to reduce the probability that the defenses would be penetrated, U.S. military doctrine is to shoot as many as five interceptors at each incoming enemy missile, as was explained to the House Armed Services Committee by the Undersecretary of Defense for Acquisition, Technology and Logistics in testimony in 2003 [4]. The idea is that if the first interceptor misses, perhaps the second won't, and so on.

Thus if Iran were to attack Europe with two missiles, and the defense were to shoot five interceptors at each one, ten interceptors might be consumed. However, only ten interceptors are proposed for Poland and so in battle those ten interceptors could be quickly exhausted. If Iran were to launch more than two missiles at Europe, there might be no interceptors left to repel further attacks.

Accordingly testing is needed to explore ways in which the defense might be made less vulnerable to multiple simultaneous or salvo attacks.

Testing with Decoys and Countermeasures

Decoys and countermeasures are the Achilles Heel of missile defense, of the missile defense systems being deployed in Alaska and California, and also of the U.S. missile defense system proposed for Europe.

To use a popular analogy, shooting down an enemy missile going 17,000 mph out in space is like trying to hit a hole-in-one in golf when the hole is going 17,000 mph. If an enemy uses decoys and countermeasures, missile defense is shooting a hole-in-one when the hole is going 17,000 mph and the green is covered with black circles the same size as the hole. The defender doesn't know which target to aim for.

In 1999 and in 2000, the U.S. Intelligence community provided assessments that North Korea or Iran would soon know, if they didn't already, how to field decoys and countermeasures.

A September 16, 1999 report by Robert Walpole, National Intelligence Officer for Strategic and Nuclear Programs, stated:

“Penetration Aids and Countermeasures

“We assess that countries developing ballistic missiles would also develop various responses to US theater and national defenses. Russia and China each have developed numerous countermeasures and probably are willing to sell the requisite technologies.

“Many countries, such as North Korea, Iran, and Iraq probably would rely initially on available technology - including separating RVs, spin-stabilized RVs, RV reorientation, radar absorbing material (RAM), booster fragmentation, low-power jammers, chaff, and simple (balloon) decoys - to develop penetration aids and countermeasures.

“These countries could develop countermeasures based on these technologies by the time they flight test their missiles.” [5]

Mr. Walpole’s assessment is not surprising since decoy and countermeasure techniques are described in the public literature and on the internet.

As Mr. Walpole noted, decoys can include objects that provide a close representation of the attacking enemy missile or its warhead encased in a re-entry vehicle. For example, a simple balloon in the shape of a cone – the shape of a re-entry vehicle – would travel out in space as fast as the RV itself and be confusing to the defender. An enemy missile could carry many of these balloons that are inflated at the time of stage separation and travel along with the re-entry vehicle and other objects, such as the “bus” that first housed all these objects, and debris from stage separations.

The debris from stage separation itself could act as a kind of decoy as that debris might reflect, turn, or tumble in a manner resembling the target re-entry vehicle.

Countermeasures could include chaff or debris deliberately scattered by the attacker with the target missile or warhead to reflect the search radar of a missile defense system. This might be short metal wires – like paper clips - of the proper length, or bits of metal foil to reflect the radar, or to cloud the view the radar might otherwise have of the target.

For missile defense systems that operate in the infrared, flares or infrared burning pellets can be released by the attacker to confuse the defender. Even the angle of the sun can be important, heating various objects in the target cluster by different amounts. The five early, successful, GMD flight intercept tests that included simple round balloon decoys were all conducted so that the sun was shining away from the interceptor and “over its shoulder” and not shining into the “eyes” of the infrared seeker on the interceptor. As a result, the sun was heating up those balloons and making them hotter and easier to spot than they would have been at other times of the day or at night.

Different missile defense systems prompt the use of different sorts of decoys or countermeasures by the offense. For example, the Airborne Laser, is a high power laser carried in a jumbo 747 aircraft. But if the enemy paints their missiles with an ordinary white paint, a white paint that is 90% reflective to the laser, then 90% of the laser energy bounces off. [6] To compensate for this, the Airborne Laser would need to be ten times more powerful.

Missiles with polished aluminum surfaces can reflect about 95% of the energy. Special coatings can raise reflectivity further, to 98% and more.

If the enemy missile rotates, as sometimes missile do, the focus of the ABL laser would no longer being in the same place. Just as burning a leaf with a magnifying glass requires keeping the sun focused on one spot, the ABL will have a better chance of working if the enemy missile is not rotating. Since missiles tend to rotate anyway, this would take almost no effort on the part of an enemy.

Yet another countermeasure against the ABL would be an ablative coating that burned

off the outside of the enemy missile. The ABL laser might burn the ablative blanket but not the missile inside.

For radars, jamming or electronic interference with the radar is another common countermeasure. An enemy also can apply radar absorbing materials to the attacking missiles or re-entry vehicles to reduce their radar cross-sections and make them “stealthy” and less easily detected by radar.

In all-out battle, missile defense radar and interceptor sites would be prime targets for an enemy. The Director, Operational Test and Evaluation notes this also in his January 2009 Report to Congress, saying, “Specific assets are lightly protected from physical attack.” [7]

Testing GMD System Target Discrimination

Last year, the MDA noted that there were five early flight intercept tests that used simple round balloons as decoys. The MDA has told the press that five successful intercept tests from 1999 to 2002 used the type of decoys we would expect “from countries such as North Korea and Iran.” [8]

But the decoys in those tests did not resemble the target re-entry vehicle (RV).

With respect to those five early tests, the decoys used were round balloons, not ice-cream cone shaped like the mock target, and with much different infrared signatures than the target warhead.

MDA has asserted that North Korea or Iran will do exactly what MDA has done, namely, use round balloons as decoys that have infrared signatures that are different from the RV, not balloons that resemble the RV in shape and/or signature.

If North Korea or Iran were to attack the United States, why wouldn’t North Korea or Iran try to confuse our missile defenses? Are we to depend on North Korea or Iran being

smart enough to make balloons that are both larger and smaller than would be required to fool us, but not the proper size to fool us?

MDA has never done a GMD flight intercept test where the decoy or decoys resembled the RV in shape and/or infrared signature.

In a report issued on February 28, 2002, the GAO reviewed the technical challenges of conducting flight intercept tests with decoys that closely match the target, and explained why the MDA had decided then to use decoys that did not resemble the target RV. [9]

Basically, the MDA and its advisors felt that such tests would be too stressing, that is, why take the chance with tests that might fail?

Thus it is misleading for the MDA to suggest now that those early flight intercept tests demonstrated the capability to discriminate real targets from well-matched decoys, or decoys that would be representative of what the Intelligence Community has assessed North Korea or Iran could field today.

The Limitations of Past GMD Flight Intercept Tests

Flight intercept tests with parts of the GMD system have been ongoing for nearly a decade.

So far there have been 14 GMD flight intercept tests. Seven of these 14 tests have been successful, but seven have failed for one reason or another. By failed I mean the primary purpose of the test was not achieved. This is not to suggest that nothing was learned or that the test was not valuable.

Two failed because the Exoatmospheric Kill Vehicle (EKV) located atop the interceptor failed to separate from its booster, and two other tests failed because the interceptor never got off the ground. One test failed because the infrared sensor on the EKV did not cool properly, and two other tests failed because of problems with the mock targets.

By that measure the success rate is 50%. But in the last five years there have only been 6 flight intercept tests, and four of those have failed, a success rate of only 33%. The MDA counts the most recent of those six tests as a partial failure, but considering that the main reason for the test was not achieved, it was a serious setback.

Thus, in the past five years there have been just two successful GMD flight intercept tests. The MDA still must carry out successfully about 20 or more, perhaps 25, flight intercept tests of different types before the system could fully demonstrate effectiveness in a series of realistic operational tests. If MDA does not improve their rate of success, it could take them 50 years to achieve 20 successful flight intercept tests. By then we may face drastically different threats to U.S. national security that may render these missile defense systems useless and outdated.

Obviously the MDA must increase both its rate of success and its rate of testing overall in the GMD program. However, the issue is not just additional tests, although many more tests will be needed, but also the design of new types of tests, the type and extent of instrumentation, the sensors characterized, and the metrics probed.

FTG-05: A Lost Opportunity

From a target discrimination point of view, during the past five years the flight intercept tests have been simpler and less realistic than the tests in the first five years. None of the GMD flight intercept tests have included decoys or countermeasures during the past seven years.

The most recent GMD flight intercept test, FTG-05, conducted December 5, 2008, was intended to be the first test in seven years to include decoys, but in this test the decoys failed to deploy.

However, even if the decoys had deployed, those decoys would have been less sophisticated than the countermeasures flown in 2002, seven years ago. To put it

differently, the early GMD flight intercept tests circa 1997-1998 used more sophisticated countermeasures than the countermeasures planned for this most recent test, FTG-05.

This means that even if FTG-05 had been “successful,” MDA would not have been able to claim that they had moved the ball forward from a target discrimination point of view. If the decoys had deployed in FTG-05 last December, the EKV would have been LESS challenged than in flight intercept tests with decoys a decade ago. In those earlier tests, the decoys also were not decoys in the true sense of the word, that is, they were not objects designed to fool the EKV by matching the target RV in infrared signature.

MDA might say that this decision was “to reduce risk,” which is short-hand for not wanting to take the chance that they would miss, that is, so that FTG-05 would not be a failure, which it turned out to be anyway when the decoys did not deploy.

However, before the FTG-05 test, MDA claimed that the countermeasures would be threat representative, as follows:

"The threat target will include representative countermeasures and a threat representative warhead re-entry vehicle that will be discriminated and intercepted by the ground based interceptor (GBI). These countermeasures are the first in a series to be use in testing the operational GBI and are fully representative of countermeasures that might exist on an adversary's intercontinental ballistic missile. These countermeasures have been designed to be threat representative and will accurately test the Ballistic missile defense system."
[10]

By going to a special set of decoys custom built for FTG-05, MDA had planned to use decoys in FTG-05 that were not as fully threat representative as claimed.

Testing the System under Realistic Operational Conditions

In addition, tests also are needed to demonstrate that the system can work at night or in bad weather, when the sun is shining in a disadvantageous direction, when the enemy re-entry vehicle is spin-stabilized to minimize its radar cross section, and alternatively when

tumbling and not spinning, when multiple attempts are needed to bring down a single target, and when more than one missile is launched by an enemy.

The MDA has fallen far behind in demonstrating these capabilities. Consider nine examples:

1. In the Clinton administration, the first test with a tumbling enemy RV [11] was planned to have been in early 2001, but it hasn't happened yet. So that's a slip of at least 8 years, and it is unlikely that the MDA will try to test with a tumbling RV anytime soon.
2. The first nighttime test [12] was to have been on December 11, 2002. It still hasn't happened either. So that's at least 7 years behind schedule if they tried a nighttime test later this year. Also unlikely.
3. The first test with decoy balloons that closely resembled the target RV was to have been in the Summer of 2002. Again, no chance this will happen any time soon.
4. In March 2002, MDA told Congress the first GMD test with multiple targets, that is, with several mock enemy missiles launched at once could take place as early as 2005. Now it is unknown when that might happen.
5. The Sea-based X-band radar (SBX) has never fulfilled its intended role in a flight intercept test, and may not be suitable for bad weather. The Director of Operational Test and Evaluation notes, "The MDA has yet to station SBX at its home port of Adak, Alaska, leaving the suitability of the SBX to be operated and maintained in that environment unknown." [13]
6. The MDA has never had a successful flight intercept test in the high-speed engagement conditions that can result from a long-range ICBM trajectory.

7. In past flight intercept tests, with the interceptor based at Kwajalein, MDA has waited until the mock enemy target launched from Vandenberg nearly reached Kwajalein before attempting an intercept.

This maximized the time to track the target and be sure of its trajectory, but left too little time for a second try if the first try missed. The Missile Defense Agency has said that their intended mode of operation will be to try more than once to hit an enemy target to increase the probability of success. But to do this requires taking the first shot much earlier so that there could be time for a second, third, or fourth attempt, something they've never tried.

8. The MDA also has never demonstrated in a flight intercept test that they can redirect or steer the Exo-atmospheric Kill Vehicle (EKV) with successive In-flight Target Updates to the correct target despite other confusing objects or decoys in the target cluster. To discriminate between similar looking or confusing objects, the system will have to be able to redirect the EKV in real time to focus on a new object different from another object the EKV may have picked out incorrectly. This has never been demonstrated in a GMD flight intercept test.

9. Some of the elements of the planned BMDS system-of-systems do not yet exist. For example, the Space-Based Infrared System (SBIRS)-High and the Space Tracking and Surveillance System (STSS) – satellite systems that are important for missile defense and warning - are billions of dollars over budget and years behind schedule. The GAO has reported repeatedly on the difficulties with these systems.

If, as the MDA has asserted in the past, the GMD system can already defend the United States when two major satellite systems for missile defense – SBIRS-High and STSS – do not exist, why should the Congress appropriate funds for these satellite systems? And if these satellite systems are required, how can the MDA claim that the system defends us today?

Of course, new testing will be required to demonstrate that these satellite systems, once they are available, can perform within the overall BMDS system-of-systems, and can perform as part of the GMD system.

Testing Proposed U.S. Missile Defenses for Europe

If, as proposed, the U.S. missile defense system for Europe is to defend both Europe and the United States, this requires the system in Europe to handle BOTH intermediate-range ballistic missiles aimed at Europe and intercontinental missiles aimed at the United States.

As such, the proposed system in Europe must operate as both a mid-course system and a post-boost, ascent phase system.

This is something that the Ground-based Interceptors (GBIs) in Alaska and California cannot do, and which has never been demonstrated with GMD interceptors in any location.

To be effective with this dual mission, the proposed system must be able to demonstrate a capability that the prototype system in Alaska and California has never demonstrated and cannot do from those locations.

The interceptors proposed to be located in Poland would be much closer to Iran than GBI interceptors in Alaska and California are to North Korea. This means the time available for response and engagement would be much shorter than the time available to intercept missiles from North Korea.

Such short timelines have never been attempted with the GMD system in a flight intercept test, and this presents new challenges that must be resolved through testing.

These shorter timelines would be stressing enough if the radar proposed to be located in the Czech Republic had adequate range to detect an Iranian missile launch as soon as it

cleared the horizon. However, recent technical analysis suggests that the proposed radar's range is too short to provide prompt track data or discrimination for long-range missiles launched from the Middle East toward the United States. [14]

Obviously these issues also will need to be resolved through rigorous testing.

In addition, Iran could perhaps field intermediate range missiles more easily than ICBMs, and so to be effective the proposed European system might have to deal with several intermediate-range missiles fired at Europe, requiring multiple, simultaneous engagements by the proposed interceptors in Poland.

This capability has never been demonstrated through flight intercept tests with the GMD system.

Before deciding to fund the proposed system in Europe, the U.S. Congress should examine in considerable detail the results from future flight intercept tests that will attempt to demonstrate the capabilities described above, and review whether then the system has "demonstrated through successful, operationally realistic flight testing, a high probability of working in an operationally effective manner," as required by the FY-2008 Defense Authorization Act and as signed by President Bush. [15]

To match the near-term plans that the MDA has for beginning construction in Europe and for deploying U.S. missile defenses in Europe, these tests will need to be planned, scheduled, and conducted soon.

Testing the Multiple Kill Vehicle Program

To try to deal with enemy countermeasures, the MDA is pursuing the Multiple Kill Vehicle program, and this is an example of another program that will require a new approach to testing at the MDA. Conceptually, the MKV is a set of smaller interceptors, that is, small kill vehicles, carried onboard a GMD Carrier Vehicle. [Potentially MKVs might be carried on the Kinetic Energy Interceptor or on Aegis interceptors, also.] If

hitting a single target with a single interceptor is like hitting a bullet with a bullet, the MKV is like hitting a shotgun with a shotgun.

The MKV concept is “many on many,” the idea being that the MKV will be able to carry as many small kill vehicles as the enemy would put up targets and decoys.

A difficulty is that each small interceptor must carry sensors, guidance, and propulsion systems, and these features add weight. For this reason the MKV interceptor may only carry a few small interceptors. Artist’s renderings of the MKV show a dozen small kill vehicles, but in actual practice only a few small kill vehicles may be all that will fit.

The MKV is like hitting a shotgun with a shotgun when the defender’s shotgun shell only has a dozen or fewer pellets. If the enemy launches more warheads, or launches more countermeasures and RV targets than the number of small kill vehicles the MKV can carry, the MKV will be overwhelmed.

In prepared testimony before the Senate Armed Services Committee on April 1, 2008, the MDA Director explained the MKV as follows:

“In the years ahead we expect our adversaries to have midcourse countermeasures. The Multiple Kill Vehicle (MKV) program is developing a payload for integration on midcourse interceptors to address complex countermeasures by identifying and destroying all lethal objects in a cluster using a single interceptor.” [16]

The single interceptor referred to in the MDA Director’s statement would be a two-stage version of the three-stage Ground-based Interceptor (GBI), or something similar to the interceptors now deployed in Alaska and California. Each GBI would carry a Carrier Vehicle that in turn would carry a number of small kill vehicles as described above.

Demonstrating that the MKV can do what the MDA Director said, namely, identify and destroy “all lethal objects in a cluster using a single interceptor” will require a new

approach to missile defense testing.

The MDA hopes to demonstrate MKV capability by 2017. [17]

The Nuclear Environment

The Pentagon does not explain it, but the Congress will remember that if we ever need to rely on missile defenses against enemy ICBMs it would be in an environment where nuclear weapons are exploding, even in an all-out nuclear war.

In all-out nuclear war, some of those enemy missiles could reach their targets, including the ones that U.S. missile defenses miss.

Some enemy ICBMs might be equipped with warhead fuses to go off before an approaching interceptor would reach them.

Some enemy ICBMs might be deliberately triggered to explode at high altitude, to cause Electromagnetic Pulse (EMP) interference that can disrupt U.S. military command and control including U.S. missile defense command and control systems. EMP effects also can disable satellite systems and computer systems that enable the U.S. to detect the source of an attack.

So when we talk about "realistic operational conditions," that includes the effects of the nuclear environment – mushroom clouds, blast, neutrons, x-rays - on U.S. missile defense silos, radars, satellites, and command and control installations.

There is no evidence that missile defense could be depended upon under those conditions. As the Director Operational Test and Evaluation puts it in the Survivability section of his January 2009, report to Congress, “Specific assets are unhardened to nuclear, biological, or chemical attack.” [18]

Conclusion

Without results from dramatically increased testing the Congress will not be adequately informed about the capabilities, limitations, or liabilities of U.S. missile defense systems.

Currently U.S. missile defenses have not demonstrated effectiveness to defend Europe or the U.S. under realistic operational conditions. U.S. missile defenses lack the ability to deal with decoys and countermeasures, lack demonstrated effectiveness under realistic operational conditions, and lack the ability to handle attacks involving multiple missiles.

With respect to the latter, and referring to the most basic capability called “Block 1”, the Director, Operational Testing and Evaluation puts it this way in his January 2009, Report to Congress, “Block 1 has not demonstrated interceptor performance in a salvo defense (multiple interceptors against multiple targets) or in a multiple simultaneous engagement (multiple interceptors against multiple targets) in a flight test.” [19]

From the examples given in the pages above it is clear that the GMD system and the U.S. missile defense system proposed for Europe require challenging and realistic testing before Congress and the administration can determine if those systems can be operationally effective and operationally suitable, and whether those systems can defend the American people and our friends and allies in Europe. To do this will require increasing both the pace of testing overall and the success rate while also adding operational realism.

End Notes

[1] MDA Report to Congress, Assessment of Testing and Targets Program, page 5, January 30, 2009.

[2] Reference: Enabling Joint Force Capabilities, DSB, 2003.

[3] See Congressional Budget Office, "The Long-Term Implications of Current Defense Plans and Alternatives," various years.

[4] Hearing, House Committee on Armed Services, March 20, 2003.

[5] Statement for the Record to the Senate Foreign Relations Committee on Foreign Missile Developments and the Ballistic Missile Threat to the United States Through 2015, by Robert D. Walpole, National Intelligence Officer for Strategic and Nuclear Programs, September 16, 1999.

[6] For example, see work on reflective white paint by NASA et al.

[7] Director Operational Test and Evaluation 2008 Assessment of the Ballistic Missile Defense System, January 2009, page 46.

[8] Letter to the Editor, *Boston Globe*, Rick Lehner, U.S. Missile Defense Agency, Washington, DC., April 11, 2008.

[9] GAO-02-124, Review of Results and Limitations of an Early National Missile Defense Flight Test, issued in February 2002.

[10] Press release, Missile Defense Agency, December 5, 2008.

[11] A test with a tumbling RV is important because an enemy might not "spin up" its warheads for greater accuracy. If aiming at Los Angeles an enemy doesn't need accuracy. Sometimes in tests the United States will have trouble spinning up an RV and it will tumble. An enemy could have that trouble also. A tumbling RV presents a "blinking" signal to the GMD sensors. But other objects in the target suite - traveling along in space with the warhead RV - are tumbling also, for example the bus, and other pieces of metal or debris from stage separations. If the GMD system cannot tell one object that is tumbling from another, it won't know which one to aim for.

[12] Nighttime tests are important because the GMD system uses infrared heat sensors to "see" the target. At night the enemy reentry vehicle may not have been exposed to the heat of the sun, and so it could be colder and harder to see.

[13] Director Operational Test and Evaluation 2008 Assessment of the Ballistic Missile Defense System, January 2009, page 46.

[14] See for example, Bulletin of the Atomic Scientists, "The European missile defense folly," George N. Lewis and Theodore A. Postol, May/June 2008, Vol. 64, No. 2.

Also see, "Technical Effectiveness of European Ballistic Missile Defense Options, Dean Wilkening, Stanford University Center for International Security and Cooperation, Wilton Park, October 31, 2008.

[15] H.R.4986, National Defense Authorization Act for Fiscal Year 2008 (Enrolled as Agreed to or Passed by Both House and Senate)

[16] Testimony, Lieutenant General Henry A. Obering III, USAF
Director, Missile Defense Agency,
Missile Defense Program and Fiscal Year 2009 Budget
Before the Senate Armed Services Committee
Subcommittee on Strategic Forces

April 1, 2008

[17] *Defense Acquisitions, Progress Made in Fielding Missile Defense, but Program Is Short of Meeting Goals*. GAO-08-448, March, 2008.

[18] Director Operational Test and Evaluation 2008 Assessment of the Ballistic Missile Defense System, January 2009, page 46.

[19] Director Operational Test and Evaluation 2008 Assessment of the Ballistic Missile Defense System, January 2009, page 45.